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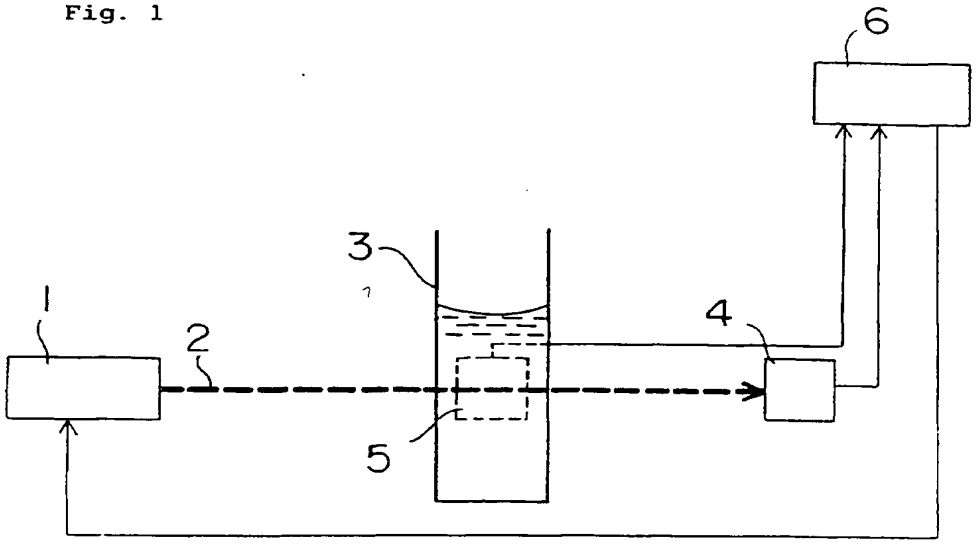
(54) Reagent and method for measuring a concentration of protein

(57) The object of the present invention is to measure a concentration of protein stably at a temperature not higher than 25°C, which is a possible ambient temperature at home, and further to expand the measurable concentration range while preventing an obstruction due to a suspending particle such as a bubble and the like, using a reagent prepared by mixing an acid in a solution containing tannin, tannic acid and m-galloyl gallic acid. By mixing the reagent in a solution to be detected to opacify the solution, intensities of at least a transmitted light or a scattered light of the solution to be detected is measured, and a protein concentration thereof is determined based on the intensity. The present invention also provides a method for measuring a concentration of a solution and a method of urinalysis, wherein a protein concentration is measured after measuring an angle of rotation.

Fig. 1



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a method for measuring a concentration of a solute dissolved in a solution to be detected, and more particularly to a method for measuring a concentration of protein and that of any optical active substance other than protein.

[0002] As a conventional method for measuring a concentration of protein, there has been a method in which trichloroacetic acid is mixed in a solution to be detected to coagulate protein, thereby opacifying the solution, and the protein concentration is determined from the resulting turbidity. However, with such method, it is difficult to stably opacify the solution to be detected at a temperature of 25 °C or higher. Therefore, it is sometimes impossible to carry out the measurement at a temperature of 25 to 40 °C, which is a normal ambient temperature at home.

[0003] As a conventional apparatus for urinalysis, there has been an apparatus in which a test paper or the like impregnated with a reagent is dipped in a urine, and a color reaction thereof is observed by a spectroscope or the like to detect the components of the urine. The test papers used herein have been required to be individually produced according to respective inspection items such as glucose and protein.

[0004] It is therefore an object of the present invention to solve the above problem. Namely, it is an object of the present invention to provide a method for measuring a protein concentration, which is highly stable and easy to maintain and manage at a temperature of 0 to 40 °C, or an ambient temperature at home, and a reagent to be used therefor.

[0005] It is another object of the present invention to provide a method for enabling a simple and highly accurate urinalysis.

BRIEF SUMMARY OF THE INVENTION

[0006] In order to solve the above-described problem, the method for measuring a protein concentration in accordance with the present invention is characterized by using one reagent selected from the group consisting of tannin, tannic acid and m-galloyl gallic acid as a reagent for changing the optical characteristics of protein only.

[0007] Further, the method for measuring a protein concentration in accordance with the present invention is characterized by adding a pH controlling agent in a solution to be detected to regulate a pH of the solution to be detected to 1.5 to 5.8.

[0008] The method for measuring a protein concentration in accordance with the present invention comprises the steps of measuring intensities of at least a transmitted light or a scattered light of a solution to be detected before and after mixing therein the reagent, and determining a protein concentration in the solution to be detected based on the intensities.

[0009] Herein, it is preferable that a protein concentration in a solution to be detected in a low concentration range is determined from the scattered light intensity, and that of a solution to be detected in a high concentration range is determined from the transmitted light intensity.

[0010] The presence or absence of an erroneous measurement due to a suspending particle such as a bubble in the solution to be detected can be detected by comparing the intensity of the transmitted light with that of the scattered light.

[0011] Moreover, the present invention provides a method for measuring a concentration of a solution comprising the steps of measuring intensities of at least a transmitted light or a scattered light of a solution to be detected before and after mixing therein the reagent, measuring an angle of rotation of the solution to be detected before mixing therein the reagent, determining a protein concentration in the solution to be detected based on the intensities of at least the transmitted light or the scattered light, and determining a concentration of any optical active substance in the solution to be detected other than the protein from the protein concentration and the angle of rotation.

[0012] This method for measuring a concentration of a solution employs the same principle as that of the above-mentioned method for measuring a protein concentration. Thus, it uses one reagent selected from the group consisting of tannin, tannic acid and m-galloyl gallic acid as a reagent. In addition, a pH of the solution to be detected is regulated in the same manner.

[0013] While the novel features of the invention are set forth particularly in the appended claims, the invention, both as to organization and content, will be better understood and appreciated, along with other objects and features thereof, from the following detailed description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0014] FIG. 1 is a side view schematically showing the configuration of a measurement apparatus used in an embodiment of the present invention.

[0015] FIG. 2 is a plan view of the same apparatus.

[0016] FIG. 3 is a graph showing the relation between the protein concentration in a solution to be detected and the scattered light intensity.

[0017] FIG. 4 is a graph showing the relation between the protein concentration in a solution to be detected and the transmitted light intensity.

[0018] FIG. 5 is a side view schematically showing the configuration of a measurement apparatus used in another embodiment of the present invention.

[0019] FIG. 6 is a plan view of the same apparatus.

[0020] FIG. 7 is a graph showing the change in the scattered light intensity of a solution to be detected.